

THE
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HIGH TEST SCORES ATTAINED BY SUBAVERAGE
MINDS

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Mushroom development in any branch of science leads to the growth and the perpetuation of fallacies of method and logic which time alone can correct. This is as true for the development of test-standardization technique as for any other similar field of research. At this time when mass tests are rapidly multiplying, and when their range of application is becoming more and more widely extended, it is necessary that we frequently reexamine the mathematical and statistical trellis work upon which such tests necessarily depend for sanction of reliability.

The present study is an attempt to formulate the mathematics of guessing, especially as it pertains to tests of the two-alternative type. What are the chances, for example, of obtaining a good record in a single group-test of fifty items, when the subject being examined lacks or does not utilize the intelligence or the information which he is supposed to possess, but proceeds, nevertheless, to mark his sheet, guessing as he continues through the items.

The prevalent opinion is thus expressed in a recent article by McCall.¹ In explaining a new type of test-method, illustrating by means of a test in United States Geography, he states:

"Let us consider first the reason for expressing a pupil's score as the number correct minus the number wrong. Imagine a pupil who is absolutely innocent of any knowledge of the physical features of the United States. Were such a pupil to take the above test and were he to mark every statement, he would according to the theory of chance mark ten statements correctly and ten incorrectly. The chances of his guessing right or wrong are fifty-fifty or one to one. His score on the above test would be:

$$\text{Score} = 10 - 10 = 0.$$

¹ McCall, W. A. A New Kind of School Examination. *J. of Educ. Research*, 1, 1920, 33-46.

In short the pupil's knowledge is zero and the method of computing his score gives him zero. Suppose instead that he knows ten statements and guesses at the other ten. Of the ten guessed at, he would, according to chance, get five correct and five wrong. That is, even though his real knowledge is ten he will show fifteen correct ($10 + 5$) and five incorrect. The method of computing his score brings out his real knowledge.

$$\text{Score} = 15 - 5 = 10.$$

A pupil who marks every statement correctly makes a perfect score, viz:

$$\text{Score} = 20 - 0 = 20."$$

The implied assumption is that "chance" will take care of the "guesser," since in the long run, and with perhaps few and unimportant exceptions, he who guesses will accidentally obtain as many answers right as wrong.

In order to bring the conditions of this study more clearly before the reader, we will assume, by way of illustration that:

(1) We are dealing with a test of 50 items, each of which the subject is required to examine and mark "plus or minus," or "true or false," or "same or opposite," or "correct or incorrect," and so on (two-alternative type);

(2) In recording the score we subtract the number wrong from the number right (unweighted);¹

(3) The subject has inferred that the test has been arranged so that there are approximately as many items of one alternative as of another, and proceeds to mark his test sheet accordingly; and

(4) The subject exercises no further judgment but places his marks indiscriminately and is guided purely by chance.

The question which immediately arises and which bears fundamentally on the validity of a test-score obtained by this method is: What are the chances that a subject proceeding as above indicated, will obtain a score of 100 per cent., of 80 per cent., of 50 per cent., of 25 per cent., of 5 per cent. of 0 per cent.? And in addition, assuming that one is examining a group of 300 individuals, among whom 36 utilize this chance, indiscriminate procedure, what proportion of these 36 may be expected to receive a score of 100 per cent., what proportion, 50 per cent., what 10 per cent., and so on?

In the present article we shall content ourselves merely with an analysis of theoretical expectation. At a later time empirical results will be presented together with some additional considerations upon which these preceding findings may throw some light, as well as some general conclusions regarding the validity of this method for measuring intelligence or the results of teaching.

¹ See excellent article on this subject by THURSTONE, L. L. A Scoring Method for Mental Tests. *PSYCHOL. BULL.*, 16, 1919, 235-240.

Theoretical Expectation

If we were to toss fifty unbiased pennies the chance of any combination of heads or tails falling upon the table could be determined by means of the formula:

$$p_{n, Q-n} = \frac{Q!}{n!(Q-n)!2^Q},$$

where p = the probability expressed as a decimal, $p_{n, Q-n}$ equals the probability of the occurrence of a certain set of possibilities n and $Q-n$, Q equals the total number of chances, n equals the number of events of one kind, $Q-n$ the number of events of the other kind, only two kinds of events being possible. This formula is really a short expression of the one generally used to find the $(r+1)$ term of any binomial expansion. The results presented in Table I were obtained by means of the binomial expansion:

$$(a+b)^n = a^n + \frac{n}{1}a^{n-1}b + \frac{n(n-1)}{1 \cdot 2}a^{n-2}b^2 + \dots + b^n,$$

in which a and b are each $\frac{1}{2}$ and n equals 50.

TABLE I
THE PROBABILITY OF OBTAINING DIFFERENT SCORES BY CHANCE

(1) No. Right (or) (No. Wrong)	(2) No. Wrong (or) (No. Right)	(3) Score in Per Cent.	(4) Chance of Obtaining Score in Column 3—1 Out of:	(5) Probability (p)
50	0	100	1 125 899 906 842 624.	.000 000 000 000 000 889
49	1	96	22 517 998 136 852.	.000 000 000 000 044 4
48	2	92	919 101 964 769.	.000 000 000 001 09
47	3	88	57 443 872 794.	.000 000 000 017 4
46	4	84	4 888 840 238.	.000 000 000 205
45	5	80	531 395 678.	.000 000 001 88
44	6	76	70 852 757.	.000 000 014 1
43	7	72	11 272 030.	.000 000 088 7
42	8	68	2 097 122.	.000 000 477
41	9	64	449 383.	.000 002 23
40	10	60	109 606.	.000 009 12
39	11	56	30 142.	.000 033 2
38	12	52	9 274.	.000 108
37	13	48	3 173.	.000 315
36	14	44	1 200.	.000 833
35	15	40	500.	.002 00
34	16	36	229.	.004 37
33	17	32	114.	.008 77
32	18	28	62.	.016
31	19	24	37.	.027
30	20	20	24.	.042
29	21	16	17.	.059
28	22	12	13.	.077
27	23	8	10.	.100
26	24	4	9.	.111
25	25	0	9.	.111

These figures are presented graphically in the following chart. It is assumed that 1,000 individuals have guessed. No factors have influenced their reactions except pure chance. The frequencies of the various scores are presented.

The 1,000 reactions, above mentioned, are presented in tabular form in Table II:

TABLE II
FREQUENCY OF SCORES FOR 1,000 GUESSERS

(1) Plus Scores	(2) Number of Persons Obtaining	(3) Minus Scores	(4) Number of Persons Obtaining
52	.1	52	.1
48	.3	48	.3
44	.8	44	.8
40	2.	40	2.
36	4.	36	4.
32	8.	32	8.
28	16.	28	16.
24	27.	24	27.
20	42.	20	42.
16	59.	16	59.
12	77.	12	77.
8	100.	8	100.
4	111.	4	111.

Zero Score, obtained by only 111 persons out of 1,000.

Minus and Zero Scores, obtained by over 50 per cent. of total.

The above tables and graph lead to the conclusion that if a person guesses in a two-alternative test of 50 items, then according to the law of chance he would obtain half right and half wrong, or a zero score only once in every 10 chances approximately. Four times in ten, he would obtain some positive score, and approximately four times in ten, some negative score.

It is also clear from Table I that the chances of obtaining a plus 100 per cent. score is only one in over one million billions! A score of 4 per cent. (disregarding sign) is practically twice as frequent as a score of 0 per cent. A score of 16 per cent. (disregarding sign) is as frequent as a score of 0 per cent. On the whole, all scores from about 60 per cent. and over are very rarely obtained by an indiscriminate procedure. Scores between 45 per cent. and 60 per cent. although not rare do not occur very frequently. But scores between 0 per cent. and 30 per cent. are quite frequent.

Let us assume a situation mentioned in the early portion of this discussion. If one is examining a group of 300 individuals, among whom 36 are guessing, what distribution of scores may be expected.

Table III answers this question and is deduced from the figures of Table I.

TABLE III
PROBABLE DISTRIBUTION OF SCORES OF 36 GUESSERS

(1) Score	(2) Frequency	(3) Score	(4) Frequency
Plus 28 per cent.	1	Minus 28 per cent.	1
" 24 "	1	" 24 "	1
" 20 "	2	" 20 "	2
" 16 "	2	" 16 "	2
" 12 "	3	" 12 "	3
" 8 "	3	" 8 "	3
" 4 "	4	" 4 "	4

Zero Score—4

Positive Scores: 16 (45 per cent.)

Negative and Zero Scores: 20 (55 per cent.)

Positive Scores Above 16 per cent.: 4 (11 per cent.)

Positive Scores Above 28 per cent.: Practically 0 per cent.

In conclusion it may be said that although our "intuition" in the past regarding the operation of the laws of chance in tests of the two-alternative type was, in the main, correct, nevertheless we have been inclined to exaggerate the frequency of zero scores, and to underestimate or overlook the frequency with which significant, positive scores might occur. Further generalizations shall be left for the later empirical study. The applications will then be more evident.

GENERAL REVIEWS AND SUMMARIES

GENERAL STANDPOINTS: MIND AND BODY

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During the past year two textbooks in psychology have appeared in both of which the authors have endeavored to present their subject matter consistently and rigorously based upon one general psychological principle. On the one hand Watson (11) has written a behavioristic psychology. On the other hand Warren (8) has given us a book that formulates the subject matter strictly from the point of view of the double-aspect theory. Watson makes his standpoint quite clear in the preface to his book. Behavior psychology is purely an American product and is not to be confused with the so-called objectivism of European objectivists such as Beer, Bethe, von Uexküll, Nuel, Bechterew, and others, who are orthodox parallelists. "The present volume does some violence to the traditional classification of psychological topics and to their conventional treatment. For example, the reader will find no discussion of consciousness and no reference to such terms as sensation, perception, attention, will, image and the like. These terms are in good repute, but I have found that I can get along without them both in carrying out investigations and in presenting psychology as a system to my students. I frankly do not know what they mean, nor do I believe that any one else can use them consistently." With similar consistency Warren keeps before the reader the double aspect he believes each psychological fact exhibits, the physiological or objective, and the mental or subjective. Doing so forces him to offer many tentative neurological hypotheses.

The most prominent book dealing explicitly with the logically fundamental problems of psychology, which has appeared during the past two years, is that of Strong (6). It presents a thoroughgoing panpsychism. What appears to us as physical is in itself psychical. "Mind has been evolved out of mind-stuff"; and this mind-stuff is feeling, or sentience. In the words of Drake (4) "while the whole book is headed toward an answer to the question

how consciousness could come to arise out of a non-conscious world, the bulk of it is taken up with answering the preliminary question, *What is consciousness?* The answer is: Consciousness is not a stuff or substance, but a function, a relation. The substance of the mind—indeed, of everything that exists—is feeling, sentience, mind-stuff. But the bare existence of this stuff does not in the least imply consciousness. It is only when a bit of sentience causes the organism to react that we speak of the organism as conscious. The organism uses the mental state not as its own state, a bit of its own existence, but as if it were the outer object itself." Consciousness is this use of a psychic state as a symbol, as the vehicle of an intention directed toward another object than itself. Drake proceeds to give a summary of what he regards as the most significant points of Strong's book and to record his own conviction of the truth of panpsychism. Turner (7) also gives an analysis of the book which he criticizes unfavorably. Finally, Washburn (9) gives a keen analysis of one important aspect of Strong's doctrine. Can the continuous and richly qualitative world of human experience be deduced from the discrete, or atomistic and purely quantitative world of physical science? Does Strong succeed, once having admitted this dualism, in reaching a monism, panpsychic or otherwise? In reply to these questions Washburn points out that we can account for the seeming simplicity, or continuity of a world that is really complex and discrete, but that we cannot deduce quality from quantity. The former is "probably just a matter of the size of the reacting organism." To be aware of an atom we should have to respond to atoms individually; and we have every reason to believe that no organism could exist small enough so to react. The reactions of the clumsy organisms with which we are familiar, overlap; and thus the spatial and temporal intervals of the real physical world become the continuous world of sensation. However, when it comes to getting quality from quantity no such method is available. "Simplicity and complexity are motor terms;" and no movement is ever qualitative. Moreover, it helps us not at all to call qualities illusory. Illusion they may be, "but there they are; reds, greens, low tones, high tones, odors; a color refusing to reveal itself to direct experience as made up of odors or even of other colors; no ultimate identity between them anywhere." "The nearest that we can come to any derivation of quality from the non-qualitative is to ask how else, except under the guise of qualitative differences, an organism could represent to itself the

essence of those molecular patterns whose true differences, those of spatial arrangement, it is unable because of the size and clumsiness of its movements, to perceive. A molecule of sugar and a molecule of fat differ in the pattern, in three dimensions, and the number of their atoms. It is impossible by means of any reacting mechanism we possess, to respond to these patterns and numbers as such. Yet it is important, we may suppose, that the organism should distinguish them: if not as patterns, then how else but by transforming them into qualities? Yes; but on the atomic conception of the universe, there is no such resource at its disposal: qualitative differences are something quite foreign. *They cannot be fitted into a universe of atoms, even a universe of mind-stuff atoms.*"

Besides these three books and articles called forth by the last there have appeared several articles bearing on the foundations of psychology and especially concerned with behaviorism. In a reply to a review, by de Laguna, of *The Animal Mind*, Washburn (10) urges in defense of dualism that introspection has the added advantage over behaviorism of directly observing to what I react in a way the outsider cannot. De Laguna (3) replies, this answer is beside the issue. "How introspection, which is by definition a sort of observation unverifiable by others, can yet possess scientific value, the only solution I know is that offered by behaviorism, viz., that introspection has such a value only in so far as the introspective observations of the subject are treated as *responses*, and not as statements of observed facts." Introspection is a peculiar type of response that, it is admitted, needs analysis and that thus far has not been adequately discussed by the behaviorist.

Weiss (12) finds the origin of dualism in the traditional psychology in the tendency of man to react toward a perplexing and dimpling situation as toward another person. Hence has arisen the "hidden-man" to be found in primitive animism and in all its descendants. As more careful study and analysis control our reactions the "hiddenman" gradually disappears. Thus in psychology the personal soul, or spirit, became the ego, or self, and this in turn has become the mind, or consciousness. This survival of the "hidden-man" in psychology has been especially tenacious due to the fact that human behavior is determined by neural processes and we have no sense organs to observe in ourselves these processes. Hence psychology to overcome this limitation in the study of human behavior has personified neural function. In another article Weiss (13) formulates the relation between physiological psychology

and behavior psychology. The two differ in assumptions, methods, and subject-matter. The assumptions of the former are based upon a dualistic system, of the latter upon a monistic system. The method of the former is that of "introspection supplemented by an analysis of the neural factors correlated with given mental patterns," whereas the method of the latter is "that of a statistical, genetic, and mechanical analysis of those movements that form the basis of human interaction." The subject-matter of the former is mind "as revealed by introspection and as correlated with neural function." Whereas the subject-matter of the latter is "human action and conduct regarded solely as a mechanical function of the environment and the reaction system." Bawden (1) finds the origin of what he calls psychologism, or the hypostasizing of consciousness in the same tendencies that at an earlier stage resulted in animism. Like every other science, art, or other enterprise psychology has had its guiding fictions. These fictions have tended to become realities. The consciousness of recent psychology is such an hallucinatory entity. In time we are aroused from our dogmatic slumber and look again at the facts as they are. To-day behaviorism is thus arousing the psychologist; and he is finding that consciousness is but a name for that group of behavior traits in which the stimulus has receded and the response is postponed. "It is the socially important articulomotor group of incipient and delayed responses that furnishes the clue to the nature of consciousness since these exhibit, in its clearest form, the arrested act or attitude in its function as superinducing still other act-inducing attitudes." Finally, Kantor (5) attempts "to define the function of critical evaluation as it applies in psychology and to point out the consequences of its correct use in that discipline." So doing leads him to a destructive criticism of behaviorism.

In the field of psychical research one book dealing with principles has recently appeared. Boirac (2) believes that psychical research has genuinely reached the scientific stage, that it is a science and that it has results to offer to the world. Moreover, he believes that it is sufficiently advanced in its development to call for a study of its methods and apparatus. In his book he offers us such a study.

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CONSCIOUSNESS AND THE UNCONSCIOUS

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During the past year the conceptions underlying the terms conscious, unconscious and their derivatives, seemed to approach three general categories: (1) Consciousness regarded as a special form of behavior. (2) Consciousness as a unique and irreducible datum of experience that is only described by a special (mental) class of attributes. (3) Consciousness as a dynamic factor, modifying human behavior and influencing human welfare. Such terms as preconscious, coconscious, unconscious, subconscious, are used either to represent transition stages between the three categories indicated, or as different aspects of them. No pronounced tendency is discernable that the confusion in the use of the terms is growing less, although the greater interest that is manifested may be regarded as an indication that greater uniformity may eventually result.

Bawden (3, 4), Weiss (91) attempt to trace the evolution of consciousness from its earliest behavior manifestations. Bosanquet (5), Feingold (22), Harvard (29), have articles in which the general nature of consciousness is analyzed. Laird (36), Larguier (37),

discuss introspection and the origin of the idea of mind. Marshall (45) believes that the "outthereness" quality of outer-world objects is a mental quality and when this quality is abstracted from our total experience, the state called consciousness remains. Mulford (50) undertakes to describe the unconscious. Reyburn (55) scrutinizes the nature of mental processes, and Thurstone (81) regards the anticipatory aspect of consciousness as developing out of the fact that every psychosis is an unfinished act in the process of being defined into overt response. Wieman (94) defines mentality as that process by which the physical organism is adjusted for some preparatory overt action upon the environment. Turner (82), Washburn (90), Drake (17), discuss Dr. Strong's (75) panpsychism. Ward (86, 87) makes a critical and careful analysis of sense-knowledge.

Broad (6) and Burroughs (8) take up the topic of design in nature. Elkus (20) discusses Warren's (88) conceptions of purpose and believes that the older danger of anthropomorphism is likely to be displaced by *physicomorphism*. Of the papers on method, Sellars (67), Richardson (56, 57), Merrill (46), Broad (7), represent the epistemological or philosophic point of view, while the standpoint of biology is represented by Jennings (33) in a discussion of the relation between determinism and human conduct in which he maintains that experimental determinism does not imply that conscious states have no (experimental) effect on action, or that everything would have happened in just the same way without consciousness. It only implies that if what now occurs were different, the earlier conditions would have been different, though what now occurs need not be predictable from nor existent in those earlier conditions.

From the systematic point of view a number of interesting articles have appeared. Hencke (30) reduces the vitalistic concept to an instinctive and emotional basis. Calkins (10) analyzes Spaulding's (73) "relations and subsistent entities" while Moore, Johnson, Hicks, Smith, Ward, have a symposium (76) on "Are the Matérials of Sense, Affections of the Mind?" DeLaguna (16) comments on the dualistic implications in Washburn's (89) textbook. Macintosh (42), Weiss (92), Turner (83), discuss those aspects of consciousness that are fundamental to methodological development. Calkins (9) outlines the personalistic conception of nature as a detailed cosmology that is regarded as not involving the difficulties to be found in animism, phenomenalism, and in de-

terminism. The reviewer believes that this is one of the clearest and best descriptions of the principles underlying her own system of self-psychology.

Dunlap (19) accounts for Fite's (24) attack on the methods of experimental psychology by calling attention to the fact that, for many philosophers, psychology is still identified with spiritualism and the many other mystic thrillers that absorb the attention, instead of being identified with the less spectacular developments in education, business and medicine. When practical applications of conscious phenomena are considered Schroeder (65) criticizes the psychoanalytic methods of Prince (53) as applied to the authorship of the book of Mormon. An anonymous writer (2) gives an excellent account of agoraphobia symptoms. Abramowski (1) reports an ingenious set of experiments on perception and recall and shows the relations between his results and the findings in pathological cases. Thalheimer (79) regards the concept of purpose as primarily of heuristic value, while Sinnett (70), and Schiller (64) feel that purpose has definite existential properties.

L. J. Russell (61), Marshall (44), Weiss (91), make an attempt to isolate the fundamental facts from which the concept of consciousness is derived. Sheldon (68) calls attention to the principle of asymmetry as a factor in the concept of reality.

Sociological implications are given attention by Cohen (13) and Follett (25). Hall (28) and McClure (43) indicate the probable future relation between psychology and governmental functions. Richardson (58), Rogers (59), Teggart (78), Thorburn (80), Urban (84), and Knowlson (35) write on the more general sociological aspects as revealed in community life, personal responsibility and reform. Loomis (40) defends naturalism and Sonneberg (72) describes the biologist's religion.

The medical aspects of consciousness are treated by Dearborn (15) who describes some functions of consciousness, and by Dryfoos (18) in the elements of psychoanalysis. Emerson (21) treats of the subconscious in its relation to other phases of consciousness. Fischer (23), Löwy (41), Morselli (49), Wells (93), refer primarily to the pathological aspects of consciousness. Cory (14) gives an interesting account of the non-literary activities of the author known as Patience Worth. Geley (26) develops the conception of a super-psychology and a super-physiology as fundamental to the so-called supernatural psychical phenomena. Gregory (27) speculates on the possibility of an independent existence of mind.

The year has been very fruitful in the recognition which philosophers have given the topic of consciousness. Calkins (11), Hicks (32), Laski (38), Spaulding (73, 74), discuss various aspects of naturalism. Carr (12), Mursell (51), Pratt (52), Radhakrishnan (54), treat of realism and perception. Devoting their attention to logic we have, Broad (7), Morgan (48), B. Russell (60), L. J. Russell (62), Schiller (63), Shelton (69), Tawney (77). Segond (66) shows the relation between imagination and scientific thinking, and Lloyd (39) gives the function of philosophy in reconstruction.

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TERMINOLOGY

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The committee appointed by the American Psychological Association to consider questions of psychological terminology in a preliminary report (3) deals with fundamental terms, such as *psychology*, *mind*, *consciousness*, *experience*, and *self*. The list contains twenty-eight terms. In most cases alternative definitions are given, often quite divergent; the aim is to include all meanings used today by recognized psychological authorities.

Solomon (2) urges that at least the most important and most frequently used terms in psychopathology "should stand for some definite, clearly expressed, specifically outlined concepts." Many such terms are used repeatedly by various writers without giving a clear concept of what they signify. He instances the vague use of such terms as *dementia præcox*, *neurasthenia*, *hysteria*, *psychosis*, *consciousness*, *the unconscious*, and *subconsciousness*. The writer specifies several familiar Freudian terms as standing in need of more precise definition.

The term *factor*, as Frost points out (1) has two distinct uses in genetic discussions. It may mean a definite property or charac-

teristic of the germ plasm, or an actual (probably material) unit of genetic segregation. Frost calls attention to the need of clearly distinguishing these two uses, especially in their bearing on the related terms *germ*, *determiner*, and *unit character*.

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APPARATUS

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Dunlap (4) records experimental results showing the unreliability of the 1/5 second stop watch for association tests. The chief objection is that there is a tendency in the experimenter to reduce variations in the records by setting up a reaction habit of a relatively constant period. The reviewer wishes herewith to correct an error in the classification of Klopsteg's (1) chronoscope in last year's review of apparatus. Through the courtesy of the manufacturers the writer has had the privilege of testing the device. This chronoscope consists of a galvanometer and fall apparatus with a switch for electrical control, together with the necessary batteries. The time reading is taken in terms of the throw of the galvanometer. The operation of the instrument is silent; the indicator returns to zero automatically. The reading may be thrown on a large scale before an audience. It is perhaps the most accurate means which we now have for ready measurement of very short time intervals; such as, less than 0.01 sec.; but for ordinary reaction time other devices are more convenient. A clock of precision in which the principal feature is the employment of a "slave" clock to do a great part of the work, leaving the master pendulum no function except that of controlling the other, is described by Bartram (1). The paper contains a mathematical discussion of the best working conditions and of the possible magnitude of errors which might arise from various causes.

Burt (2) has described a pneumograph which automatically

records the instant inspiration and expiration respectively begin and incorporates the time record in the breathing record. Nutting (7) has designed an instrument which takes the place of the Marten's comparison photometer for use as a brightness photometer, illuminometer, and reflectometer. The instrument is simple and comparatively inexpensive and avoids the use of the polarization principle. The density is controlled by means of a precision iris diaphragm.

A monochord (5) device for the testing of the upper limits of tones is attracting attention among otologists. By stroking the wire with a turpentine brush longitudinal vibrations of high frequency are set up. The instrument is calibrated to 25,000 v.d. The lower range of pitch is provided for by the usual manner of producing transverse vibrations by bowing. While the instrument is very ingenious and simple, it is only of rough qualitative value, because in the higher regions the tones can not be made sufficiently intense; a person who falls out at 17,000 v.d. with this instrument may hear as high as 25,000 v.d. when a louder tone is produced in the telephone receiver.

A pitch range audiometer (3, 8) has been devised for the measuring of acuity of hearing quickly and accurately for all pitches within the principal functional tonal range with a pure tone. The instrument is built on the principle of induction. The pitch is determined by the speed of revolution of a toothed wheel, and is measured by an electrical tachometer. The intensity is varied by a series of resistance shunts and the tone is delivered through a telephone receiver. It covers a range from 15 vibrations up to 8,000 vibrations. The test can be made in a fraction of the time that it could be made with tuning forks and gives vastly more details.

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TEXT-BOOKS AND GENERAL TREATISES

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Three interesting text-books of psychology have appeared this year. They differ considerably from one another and from the traditional text-book to which we have grown accustomed during the past years.

Hunter's *General Psychology* (4) is the broadest in scope but the least intensive in treatment of special topics. His plan has been to give the student a general idea of mind in all its manifestations. The originality of the book consists principally in the number of fields described and the arrangement of the material. The behavior viewpoint is prominent but not dominant. Introspective data are given but inasmuch as psychological observation does not necessarily mean a "looking within" the student is advised to consider introspection as synonymous with observation as practised in the other sciences.

Part I starts with a brief survey of animal psychology with special references to methods of experimentation. There follow descriptions of mental tests and mention of the application of psychology to business, law, etc. The facts of abnormal psychology which are particularly interesting to psychologists, such as paranoia, multiple personality, and psycho-analysis form the next chapter. Part I ends with a brief account of the self and its social aspects, social institutions and racial psychology. This material is presented in the first part of the book in order to interest the student in concrete problems and to counteract the idea that normal human psychology is all-important in the study of the mind. The author states, however, that one may begin with Part II and if it is a short course, the chapters of Part I may be used as collateral reading.

Part II begins with Attention, which is described as "the clearness into and out of which objects move." Under the subjective conditions of attention are included instincts, habits and the laws of association. The student is then given an adequate account of the nervous system, and reflex and instinctive action. The chapter on Emotion which includes a description of the important work of Sherrington and Cannon, McDougall's analysis of the emotions and Lipps' theory of empathy precedes the chapter on the Affective

processes. The psychology of the senses, including Weber's Law and visual space is covered in two chapters. The last chapters are concerned with imagination, memory and thought. Hunter has avoided any lengthy discussions and has been successful in selecting important facts and presenting them with equal emphasis. In the short space at his command, however, he has been able to do little more than stimulate the student to further study.

The most original text-book which has appeared in years and one which most strongly reflects the opinions and personality of the author is Watson's *Psychology from the Standpoint of a Behaviorist* (15). The title is a very honest one. It is an outline of the manner in which one of the behaviorists desires to see psychology developed. Perhaps the term outline may be misleading in that a great many facts of importance are given in some detail. The results are, in many instances, admitted to be tentative and as suggestions for future work. Indeed, there are so many hints for further experimentation and such concrete and practical descriptions of methods which lay entire stress upon objective control that the book will undoubtedly be more useful to research students than to members of an elementary course. As Watson has well described the features which first impress the reader we may quote from his preface; "The present volume does some violence to the traditional classification of psychological topics and to their conventional treatment. For example, the reader will find no discussion of consciousness and no reference to such terms as sensation, perception, attention, will, image and the like. These terms are in good repute, but I have found that I can get along without them both in carrying out investigations and in presenting psychology as a system to my students. I frankly do not know what they mean, nor do I believe that anyone else can use them consistently. I have retained such terms as thinking and memory, but I have carefully redefined them in conformity with behavioristic psychology."

The author has, indeed, been very successful in avoiding these terms, but at times it was necessary to make a considerable circumlocution in order to do so. The "Psychology" is, of course, in terms of stimulus and response. Although no introspection is used the spoken word is admitted as a response of the human organism.

It is impossible to give here more than a few of the outstanding features of the book. It should be said at the outset that most of the

facts to be found in the traditional text-books are to be found here, but in unexpected settings and original terms. Four methods for obtaining psychological data are described: "1. Observations with and without instrumental control. 2. The conditioned reflex method." 3. The verbal report method. 4. Methods of Testing.

Under the title of "The Receptors and Their Stimuli" are given many of the facts of sensations. Instead of speaking of the sensation of red from wave lengths between 760 and 647 mm., to take an example, we learn that the subject when stimulated by these wave lengths replies "I see red." There are excellent cuts of the sense organs, in fact throughout the book there are numerous well-chosen illustrations of the human anatomy. Space perception and visual hallucination are included in this chapter. Before describing the responses of the organism we are given the essential facts of the nervous system and the muscles and glands. Under the latter are included the liver, kidney, thyroid, etc. The first hereditary motor response to be described is the emotional. Results are given of experiments which the author made upon the reaction of babies to various objects such as pigeons, rabbits, rats, etc. In the first months no fear was shown toward these animals. The reader will find a considerable amount of original data in the investigations by the author, especially upon children, in almost all of the succeeding chapters. As a suggestion for a practical study of the emotions a class experiment is described in which individuals are rated according to various characteristics of their emotional life.

In the chapter upon instincts there is a detailed description of investigations upon nursing, grasping reflex, defense movement, crawling, etc.

Habits are classified as explicit bodily habits and explicit and implicit language habits. We find that it took a hundred and fifty trials for a child to learn through experience to avoid grasping at a flame. The learning curve and retention are treated under the subject of bodily habits. There is a genetic treatment of language which follows a detailed description, with illustrations, of the vocal apparatus. In regard to thought the author states that it may be explicit or implicit.

The material generally found in a chapter on memory is here found in the chapter dealing with language. In the chapter upon "The Organism at Work" Watson states that the psychology of fatigue is in such a helpless position that the concept of fatigue had

better be dropped. It is simply necessary to state that results are obtained under such and such conditions.

Dr. Arai's experiments upon the work curve are given at some length. A considerable part of the chapter is concerned with the effect of drugs and abnormal conditions upon work. The psychology of habit is continued in the chapter on "Personality and its Disturbances." Various methods of studying personality behavioristically are here included. There is very much more on instincts, habits, and learning in general than is ordinarily found in a text-book, so that even those who desire a fuller and more conventional treatment of sensory psychology may find it an advantage to use this as a supplementary text. The book is written with a great deal of vigor and holds the interest of the reader. It might be added that Watson takes occasion to mention the deficiencies of the air medical service, especially in the employment of unscientific otologists, obstetricians and gynecologists, instead of psychopathologists and psychologists.

Warren's *Human Psychology* (14) will appeal to those instructors who have not taken an extreme position in regard to psychological methods, for mind is described structurally, functionally and behavioristically. The aim of the author seems to be to give the student a brief and straightforward account of all the important facts and problems with which a student of experimental psychology should be acquainted before starting independent reading and research. The book therefore covers a very wide range of subjects. As in the case of the other books summarized, there is much originality shown in the classification and arrangement of the material. Another feature of the book is the close coördination throughout the text, of the psychological and the physiological facts. In fact, the nervous mechanism is very strongly emphasized. After a short chapter, descriptive of the organism as a whole, there are several chapters upon the physiology of the nervous system, with special emphasis upon the nervous arc and factors of stimulation and response. The two chapters upon behavior cover reflexes, instincts, and intelligent action. Under the last heading we find a detailed account of the learning process. A short chapter deals with some of the important factors of consciousness. The psychology of the senses is covered in two chapters. Experience is divided into sensation and ideas. There is a general description and comparison of these two elements of consciousness. Perception, imagery, feelings and conations are included under the

heading "Primary Mental States." We find a general description of perception and special treatment of space, illusion, time, rhythm, discrimination-threshold, etc.

Distinction is made between memory images and images of the imagination. There is also a psychological explanation of general images. Special attention is also given to the various attributes of feeling.

Secondary mental states include the emotions, voluntary action and thought as expressed in language. There is a very elaborate classification of emotions and a list of the sentiments together with their origin. The various types of central control and volition as well as the nature and factors of the will are briefly sketched. The student is informed of the controversy over imageless thought and is given a psychological explanation of meaning and value. A description of the laws of the association of ideas leads to a few pages upon dreams and rational thinking.

A chapter is devoted to a description of the general set of the organism, producing attitudes which are termed interest, desire, attention, etc. After showing what is meant by character and classifying the temperaments, the author shows how these various phases make up the general character or self. There is a useful summary of the contents of the book and several pages of special conclusion. Four problems are discussed in the appendix, namely the mind and body relation, including the question of thought transference, mechanism and purpose, neural activity and theories of color vision. At the end of each chapter there are references to chapters of standard text-books which may be used as collateral reading. There are also several practical exercises, directions for performing which are given at the end of the book. There are excellent illustrations, especially of the essentials of the human anatomy. (The recent text-books in psychology make it unnecessary to use a separate physiology in general courses.) The book seems best suited for advanced courses. It should be used in elementary courses only if the students are above sophomore grade.

Pillsbury has made a number of important changes in a new edition of his *Essentials of Psychology* (10). The various topics have been brought up to date, wherever it has been deemed necessary. The greatest number of changes have been made in the chapters on "Memory and Imagination" and on "The Emotions," ten pages having been added to the former. In the latter chapter the latest facts, such as the results of Cannon's work, are now in-

cluded. A new chapter entitled "The Types of Mind" which deals briefly with the nature and method of intelligence tests, has been added. Many of the paragraph headings have been altered and new ones added. There are several new cuts. The exercises and references at the end of each chapter have been thoroughly revised and there is now in addition a list of questions. The author has also improved his style throughout the book.

Fröbes (2) considers that his text-book is a supplement to a general outline and to research in special fields. He states that his book differs from the general run of text-books in that it is midway between a condensed outline and a reference book intended for specialists. His aim has been to give to psychologists a book somewhat similar to that which medical men have in Tigerstedt's *Physiologie*.

The book is ponderous both in size and style. Only the first volume has as yet appeared and its six hundred odd pages brings one only to the end of the chapter on the laws of association.

One might describe the book as a composite photograph of the writings of the better-known psychologists such as Wundt, Müller, Stumpf, Fechner, Titchener, Witasek, etc. Very few references are beyond 1914 and many of them date from the early days of experimental psychology. The treatment is very conservative and there is absence of any definite point of view or critical analysis. The modern tendencies in experimental psychology have not been recognized and few references have been made to the work done in America. There is no attempt at originality, the various subjects being explained with quotations or paraphrases from various authors. For example, under the differential threshold for pitch one is given results from Preyer, Witasek, Brentano and Stumpf within the space of ten lines.

The first third of the book deals with the sensations. The second third with auditory perception and space, and movement. In the last third of the book there is a brief treatment of thought, perception and comparison. Following this there is a relatively extensive description of psychological methods including the principles of correlation, and finally a statement of the laws of association. The book is a presentation of experimental results rather than methods or theories. It may be helpful to the student in starting a problem or writing a seminar paper, especially if he has not a complete bibliography or good library facilities.

Kaploun's *Psychologie generale* (5) is a system of psychology

which, as the sub-title suggests, is based upon a study of dreams. The author's desire is to be empirical. He has therefore developed a system of psychology from about five hundred observations upon himself which he has made during the course of five years. He has refrained from using the observation of others on account of their unreliability. One suspects that the author's generalizations are, to some extent, determined by his training in the philosophical psychology of the last century. One is reminded, in places, of Lipps, although he has not even Lipps' tolerance for modern experimental facts. It is impossible, in this place, to review the book in detail. An idea of it may be obtained from the fact that the author presupposes three egos. There is the central ego which is "adynamique." It uses no energy except, perhaps, the vital energy which only disappears at death. There is also the automatic ego and a third ego which is a combination of the two. Much use is made of the concept of the focus of the mind, which is not to be confused with attention, and the explicit function which probably corresponds to Wundt's apperceptive mass.

Goddard's *Psychology of the Normal and Subnormal* (3) is not only for students in normal schools and colleges, but also for parents and for the general reader who is interested in teaching, in social problems, vocational guidance, etc. The various subjects are treated under the threefold aspect of physiology, normal, and abnormal psychology. Extensive descriptions are given of the neural basis for the various forms of mental activity. These activities are then described as they appear in the normal individual. Thus far the book resembles the usual text-book. The reader, however, is led beyond this into the normal field. In fact the impression one receives is that of an abnormal rather than normal psychology. The facts of the two fields, however, are brought closely together so that they supplement each other. There are numerous illustrations and a summary is given at the end of each chapter.

The first chapters are concerned chiefly with the nervous system and its development. Memory and attention and the association of ideas, are shown to be inherent properties of the nervous mechanism. The higher mental processes are then described. Considerable attention is given to the problems of emotional life, and to will, action and habit. The author has presented a view of emotions which he believes has not before appeared in a textbook. In the appendix he has printed Mosso's article on

"The Mechanism of the Emotions." A short second part of the book describes some of the possibilities of applying the principles of the first part to practical problems of life especially to the training of the feeble-minded. The book is written in simple, and so far as possible, non-technical language. The facts are frequently illustrated by experiences which will be readily understood by the general reader. As a textbook it is probably best adapted to a course in abnormal or in comparative psychology.

Bridges in *An Outline of Abnormal Psychology* (1) lists and classifies the abnormal manifestations of the various fields of psychology. He also describes very briefly the theories and explanations of these manifestations. Part I follows the division of the ordinary human textbook, namely sensation, perception, memory, etc. Part II lists the symptom complexes of insanity and Part III those of the border-line diseases. There are lists of references at the end of each chapter. The author desires the book "to serve as a guide for students of abnormal psychology in the absence of a comprehensive text-book." It seems to the reviewer that the book will be useful to students of abnormal psychology, even though they may have access to text-books on the subject, for it will be of considerable aid to them in systematizing and remembering the many necessary facts of the subject.¹

Starch's *Educational Psychology* (13) may be used as a text-book, as well as a reference book for those working in the field of educational psychology. The author's chief aim has been to present the most important experimental data in the field of education. He has not dealt to any extent with theory, since he desires his book to be as practical as possible. He has also devoted less space to a discussion of instincts, fatigue and imagery than has usually been done. The first part of the book is concerned with the native equipment of the human organism. The range of variation in the capacities of pupils is shown. There is also a treatment of the correlation of various capacities. This leads to a discussion of results relative to sex differences. In the part upon the inheritance of mental traits there is first a description of the work upon defectives and then of the resemblance of brothers and sisters and twins. This part ends with a description of intelligence tests.

Part II gives considerable data upon the learning curve and the transfer of training. The third part is concerned with the

¹ A critical review of this book by S. I. Franz appeared in the *BULLETIN*, June, 1919.

methods of measuring the ability in learning special school subjects. The author considers this part unique for a text-book. Considerable data are presented which will assist in teaching these subjects. A large part of the book consists of tables and graphs.

Lipmann's *Psychologie für Lehrer* (6) is similar in treatment to his psychology for lawyers. It is interesting in style and subject matter. He has been able, in a short space, to present some of the most essential facts clearly and concisely. It is especially interesting to note the change which has taken place regarding the German ideas on educational methods. When on the subject of "Authority" Lipmann states that the teacher should make very little use of his authority in his relation to the pupil. He should not insist upon his statements being accepted uncritically, but should prove, so far as possible, the assertions he makes. Further the student should be told that true religious values and ideals are a matter of faith rather than knowledge and should be distinguished from so-called dogmas which masquerade under the guise of religion. Attention is particularly directed to the reliability of statements made by children, to memory, fantasy, and play, feeling, will and character, including questions of morality. There is no attempt to treat these subjects more than superficially, but the book will undoubtedly prove suggestive to teachers, especially in Germany.

Although Link's *Employment Psychology* (7) is essentially for those who desire to enter the field of industrial psychology, and for the business man who wishes to know the practical value of psychology in the selection of employees and in putting the right man in the right place, the book will make a good text for part of a course in applied psychology. Link is very conservative in his estimate of the value of the various psychological tests he describes. The book will probably win the confidence of the business man. It should also put the student in the proper attitude toward applied work. The reader is shown how the tests are devised, how their practicability is determined, and finally the manner in which they are applied, the results obtained, the calculations made and the deductions drawn. Many actual experiments in selecting the personnel for different businesses are described in detail. Not only are successful methods given but also some which were negative in result. By this means the student is warned of the danger of too much optimism and advised of the necessity for great patience. A number of tests for the selection of employees are briefly described. Part of the book is devoted to trade tests. Another part deals

with the method of comparing men according to impression, output, etc. The last part of the book contains general remarks upon employment methods. An appendix gives a more detailed account of some of the tests and methods of computing results. The book, though serious in tone, has an easy interesting style.

Seashore believes that it is possible, through scientifically determined tests, to decide whether one possesses sufficient musical ability to warrant fitting oneself for a musical career. In his book, *The Psychology of Musical Talent* (12), he has described tests for determining the presence of the essential features in musical ability, such as the sense of pitch, of intensity, of timbre, of consonance, etc. Experiments which have been carried on in Seashore's laboratory are described. There are also illustrations and descriptions of instruments invented by the author. There are included short explanations of the concepts necessary to an understanding of the psychology of music. The book will be of value to teachers of music, and instructors will find it useful in courses of general and applied psychology.

Peterson and David's *The Psychology of Handling Men in the Army* (9) will be of value not only to officers but to students of military psychology and may also serve as collateral reading for a course in applied psychology. The subjects treated are competition, play, team-play, leadership, the principles of learning, habit, discipline, and loyalty. Most of the chapters are divided into three parts. The first part is written by Lieut. David in a somewhat popular style, setting forth the practical aspects of the subject. Peterson explains the underlying psychological principles in the second part. The third part shows the immediate application of the facts and also contains quotations relative to the subject from competent army officers.

Part I of Marshall's *Mind and Conduct* (8) is entitled "The Correlation of Mind and Conduct." The first question discussed is the nature and limits of the correspondence of consciousness and behavior and the place of the subconscious. In behavior we find instinctive action opposed to adaptive action. In consciousness there is the opposition of instinctive feelings and reason. Habits are termed pseudo-instincts. If instinctive action is slowed down it shows the characteristics of adaptive action. On the conscious side, as action becomes more automatic instinctive feelings take the place of thought, and then, in turn disappear. The action thus becomes entirely unconscious.

Marshall describes the empirical self which is a "similacrum of the non-presentable self" or conceptual self which is described as an "undifferentiated mass of psychic elements." It is from the ego of self-consciousness that we learn the general nature of the self.

The second part deals with "Some Implications of the Correlation." The chief characteristic of self is the creativeness, evidence for which is to be found in the existence of ideals which are not part of the real world. In discussing freedom and responsibility the author states that we never do anything which, at the time of action, seems to us irrational. We are responsible for our acts in that we are the author of them. In this sense responsibility has ethical significance.

In the third part Marshall discusses the rôle of pleasure, happiness, intuition and reason in conduct.

Ritter in his two volumes upon *The Unity of the Organism* (II) has given much information upon the structure of the cells, cell theories, the relation of the organism to the cells, neural integration and nerve action. He discusses the connection between the physical and psychical and closes with a theory of consciousness. His specific information is drawn from the works of others. As he himself states in the preface, he is a complete stranger in the fields treated, namely the chemistry of the organism, heredity, human consciousness and the nature of knowledge. The book is highly speculative and philosophical. Owing to lack of definition in the style, it makes rather difficult reading.

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NOTES AND NEWS

THE following items have been taken from the press:

A COURSE of lectures on "Psychology and Health" was given by Professor G. M. Stratton, of the University of California, in San Francisco, during the months of January and February.

DR. SCHACHNE ISAACS, formerly instructor in psychology at the University of Cincinnati, has been awarded a fellowship in psychology by the Society for American Fellowships in French Universities.

THE New School for Social Research offers three fellowships in social research for the academic year 1920-1921. Each fellowship carries a stipend of \$2,000, and successful candidates required to be in residence during the period of their tenure. Further information may be obtained from Mr. Horace M. Kallen, 465 West 23d Street, New York.

